Supplement to The Wireless & Electrical Trader, April 19, 1947

"TRADER" SERVICE SHEET

808

AERODYNE 302

A.C./D.C. 3-BAND SUPERHET

DESIGNED to operate from 100 V or 200 V A.C. or D.C. mains, the Aerodyne 302 is a 4-valve (plus rectifier) 3-band superhet. The prescribed mains voltage ranges are 100-120 V and 200-240 V, 40-100 c/s in the case of A.C. It may be used on 250 V mains if the adjustment screw is removed altogether.

A tuning assembly which contains all the components (except the tuning gang and waveband switch unit) intimately associated with the R.F. and oscillator tuning circuits, forms a screened unit which may easily be removed for inspection or replacement.

Release date and original price: December, 1945; £13, plus £2 15s 11d purchase tax; increased November, 1946, to £13 13s, plus £2 18s 9d purchase tax.

CIRCUIT DESCRIPTION

Aerial input via mains isolating capacitor **C1** and coupling coils **L1** (S.W.), **L2** (M.W.) and **L3** (L.W.) to single tuned circuits **L4, C32** (S.W.), **L5, C32** (M.W.) and **L6, C32** (L.W.); "bottom" coupling on M.W. is provided by **C2, R1**, which are common to aerial coupling and tuning circuits.

First valve **(V1, Mullard metallized CCH35)** is a triode hexode operating as frequency changer with internal coupling. Triode oscillator grid coils **L7** (S.W.), **L8** (M.W.) and **L9** (L.W.) are tuned by **C33.** Parallel trimming by **C34** (S.W.), **C35** (M.W.) and **C10, C36** (L.W.); series tracking by **C11** (S.W.), **C12** (M.W.) and **C13** (L.W.). Reaction coupling by coils **L10** (S.W.), **L11** (M.W.) and **L12** (L.W.).

Second valve **(V2, Mullard metallized EF39)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C5, L13, L14, C6** and **C16, L15, L16, C17.**

Intermediate frequency 460 kc/s.

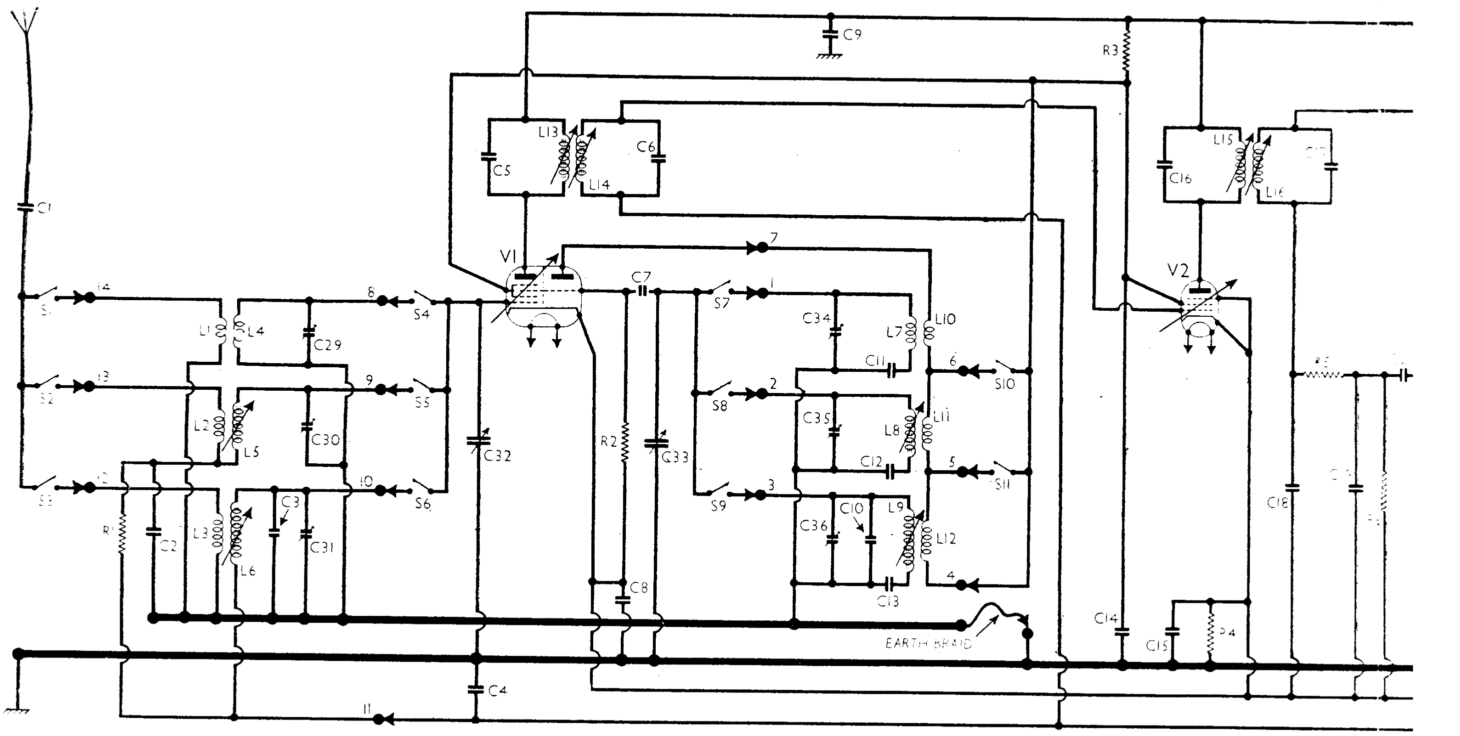
Diode second detector is part of double diode triode valve **(V3, Mullard metallized EBC33).** Audio frequency component in rectified output is developed across load resistor **R6** and passed via coupling capacitor **C20** and manual volume control **R7** to C.G. of triode section, which operates as A.F. amplifier. I.F. filtering in diode circuit by **C18, R5** and **C19.**

Second diode of **V3,** fed from **L16** via **C21,** provides D.C. potentials which are developed across load resistor **R10** and fed back through decoupling circuits as G.B. to F.C. (except on S.W.) and I.F. valves, giving automatic volume control. Delay voltage, together with fixed G.B. for **V1, V2** and **V3** triode is obtained from the drop along **R4,** which is common to the cathode circuits of the three valves.

Resistance-capacitance coupling by **R8, C23** and **R11,** via grid stopper **R12,** between **V3** triode and pentode output valve **(V4, Mullard CL33).** Fixed tone correction in anode circuit by **C24.**

When the receiver is operated from A.C. mains, H.T. current is supplied by half-wave rectifying valve **(V5, Brimar 1D5)** which, with D.C. mains, behaves as a low resistance. Smoothing by resistors **R14, R15** and electrolytic capacitors **C25, C26** and **C27.** H.T. circuit R.F. filtering by **C9.**

Valve heaters, together with scale lamp and tapped ballast resistor **R17** are connected in series across mains input. Mains R.F. filtering by **C28.**



Circuit diagram of the Aerodyne 302 A.C./D.C. 3-band superhet. The mains voltage adjustment consists of a screw and two sockets for normal low v... high voltage mains. For mains of 250 V the screw is removed entirely. The heavy line, above the chassis line under V1, represents the frame of th... assembly, the fourteen connecting tags and the earthing braid being marked to agree with the chassis and assembly illustrations overle...

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on A.C. mains of 223 V, using the 200-240 V tapping on the heater ballast resistor. The

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 CCH35	170	2·7	92	2·4
	Oscillator			
	92	4·0		
V2 EF39	170	5·6	92	1·7
V3 EBC33	85	1·7	—	—
V4 CL33	192	37·0	170	3·9
V5 1D5†	—	—	—	—

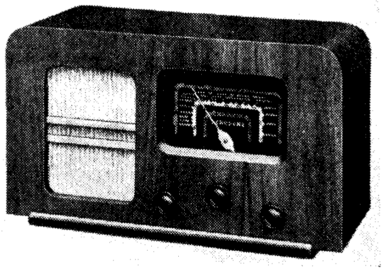
† Cathode to chassis, 231 V, D.C.

receiver was tuned to the lowest wavelength on the M.W. band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Avometer, chassis being the negative connection.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (recessed grub screws); remove the two plywood strips (two countersunk-head wood-screws each) from the underside of the cabinet; if the four chassis fixing screws (with metal washers) are removed the chassis



The appearance of the Aerodyne 302 A.C./D.C. receiver.

and speaker may be withdrawn as a single unit.

Removing Tuning Assembly.—Unsolder from the two tag strips on the assembly the fourteen leads connecting it to the chassis, also the braided lead which is joined to an earthing tag adjacent to the assembly.

Remove the two cheese-head screws (with nuts and locking washers) securing the tuning assembly to the side of the chassis, and lift it out.

When replacing, the connections may be identified by reference to the numbered tags in the under-chassis illustration and the numbered connections on the circuit diagram. Most of these connections come from the switch unit, whose diagram appears in col. 3 overleaf.

Although all the interconnecting leads are coloured, the available colours are subject to supply conditions and cannot be relied upon for coding.

COMPONENTS AND VALUES

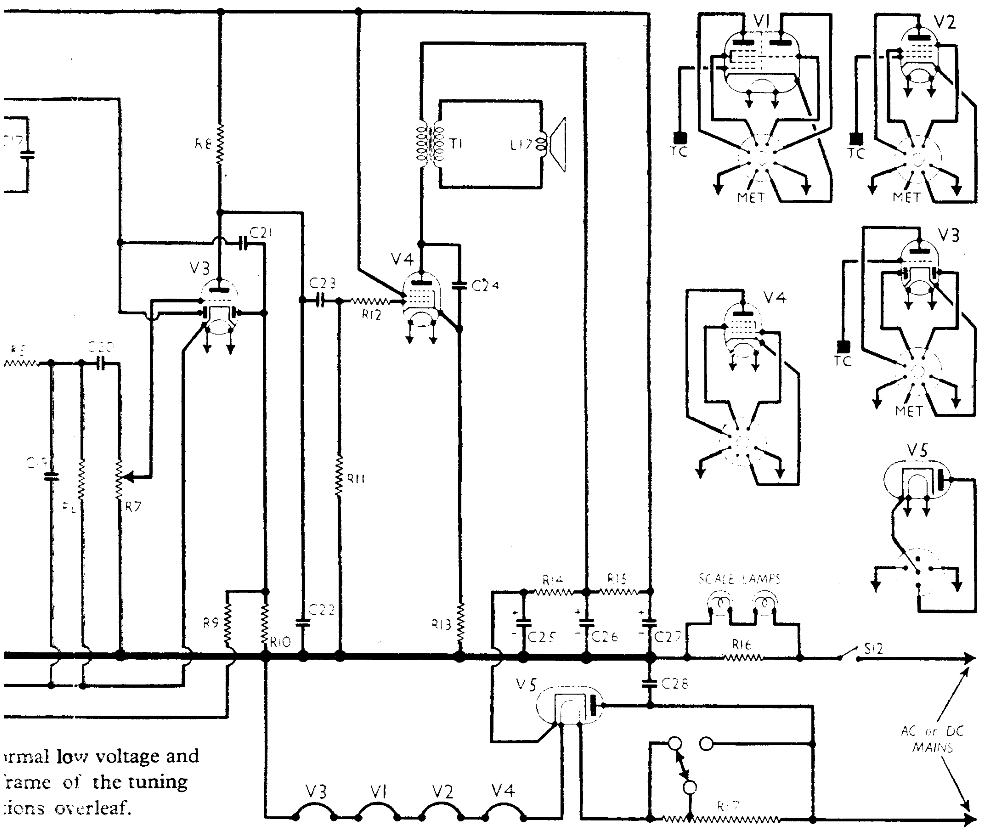
Dealers are reminded when ordering replacements to mention the fact that component numbers were taken from this Service Sheet as these numbers do not agree with those on the maker's diagram.

	RESISTORS	Values (ohms)
R1	Part aerial M.W. coupling	680
R2	V1 osc. C.G. resistor ...	47,000
R3	H.T. feed resistor... ...	10,000
R4	V1, V2, V3 G.B. resistor...	100
R5	I.F. stopper	47,000
R6	V3 signal diode load ...	470,000
R7	Manual volume control ...	1,000,000
R8	V3 triode anode load ...	47,000
R9	A.V.C. line decoupling ...	2,200,000
R10	V3 A.V.C. diode load ...	1,000,000
R11	V4 C.G. resistor	470,000
R12	V4 grid stopper	47 000
R13	V4 G.B. resistor	150
R14	H.T. smoothing resistors	560
R15		1,500
R16	Scale lamp shunt... ...	40
R17	Heater circuit ballast, total	700†

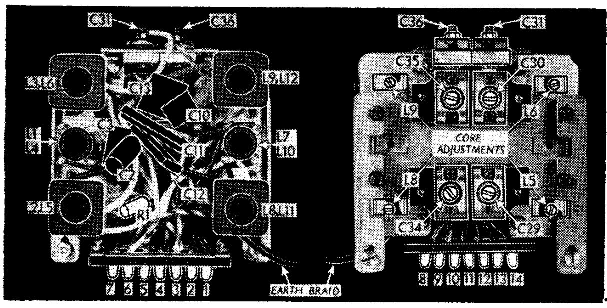
† Line cord, tapped at 100 Ω—600 Ω from V5 heater.

	CAPACITORS	Values (μF)
C1	Aerial isolator	0·0002
C2	Aerial M.W. coupling capacitor	0·005
C3	Aerial L.W. fixed trimmer	0·000056
C4	A.V.C. line decoupling ...	0·05
C5	1st I.F. transformer tuning capacitors	0·0001
C6		0·0001
C7	V1 osc. C.G. capacitor ...	0·000047
C8	V1 cathode by-pass ...	0·1
C9	H.T. circuit R.F. by-pass	0·1
C10	Osc. L.W. fixed trimmer...	0·000056
C11	Osc. circ. S.W. tracker ...	0·0056
C12	Osc. circ. M.W. tracker ...	0·000575
C13	Osc. circ. L.W. tracker ...	0·0002
C14	H.T. feed decoupling ...	0·1
C15	V2, V3 cathode by-pass ...	0·25
C16	2nd I.F. transformer tuning capacitors ...	0·0001
C17		0·0001
C18	I.F. by-pass capacitors ...	0·0001
C19		0·0001
C20	A.F. coupling to V3 triode	0·005
C21	V3 A.V.C. diode coupling	0·0001
C22	V3 anode I.F. by-pass ...	0·0002
C23	A.F. coupling to V4 C.G....	0·005
C24	Fixed tone corrector ...	0·005
C25*	H.T. smoothing capacitors	8·0
C26*		16·0
C27*		16·0
C28	Mains R.F. by-pass ...	0·05
C29‡	Aerial circ. S.W. trimmer	0·00005
C30‡	Aerial circ. M.W. trimmer	0·00005
C31‡	Aerial circ. L.W. trimmer	0·00005
C32†	Aerial circuit tuning ...	0·0005
C33†	Oscillator circuit tuning...	0·0005
C34‡	Osc. circ. S.W. trimmer ...	0·00005
C35‡	Osc. circ. M.W. trimmer...	0·00005
C36‡	Osc. circ. L.W. trimmer...	0·00005

* Electrolytic. † Variable. ‡ Pre-set.



rmal low voltage and
rame of the tuning
ions overleaf.



Two views of the tuning assembly after dismounting it from the chassis and removing the cover. On the outer side (right) are seen all the R.F. and oscillator alignment adjustments.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial S.W. coupling coil ...	0·1
L2	Aerial M.W. coupling coil ...	0·4
L3	Aerial L.W. coupling coil ...	80·0
L4	Aerial S.W. tuning coil ...	Very low
L5	Aerial M.W. tuning coil ...	2·5
L6	Aerial L.W. tuning coil ...	20·0
L7	Osc. S.W. tuning coil ...	Very low
L8	Osc. M.W. tuning coil ...	1·5
L9	Osc. L.W. tuning coil ...	4·5
L10	Osc. S.W. reaction coil ...	0·1
L11	Osc. M.W. reaction coil ...	0·6
L12	Osc. L.W. reaction coil ...	1·1
L13	1st I.F. trans. { Pri. ...	5·2
L14	1st I.F. trans. { Sec. ...	5·2
L15	2nd I.F. trans. { Pri. ...	6·8
L16	2nd I.F. trans. { Sec. ...	6·8
L17	Speaker speech coil ...	2·5
T1	Output trans. { Pri. ...	320·0
	Output trans. { Sec. ...	0·2
S1-S11	Waveband switches ...	—
S12	Mains switch, ganged R7...	—

GENERAL NOTES

Switches.—S1-S11 are the waveband switches, ganged in a single rotary unit under the chassis deck, beneath the tuning assembly. The unit is indicated in our under-chassis view, and shown in detail in the diagram in col. 3, where it is drawn as seen when viewed from the rear of an inverted chassis.

The table below gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and **C**, closed.

S12 is the Q.M.B. mains switch, ganged with the manual volume control **R7.**

Switch Table

Switch	S.W.	M.W.	L.W.
S1	C	—	—
S2	—	C	—
S3	—	—	C
S4	C	—	—
S5	—	C	—
S6	—	—	C
S7	C	—	—
S8	—	C	—
S9	—	—	C
S10	C	—	—
S11	—	C	—

Tuning Assembly.—All the R.F. and oscillator coils **L1-L6** and **L7-L12,** together with their trimmers and other associated components, are housed in an assembly mounted at one end of the chassis deck, over the waveband switch unit.

This assembly is indicated in our plan view of the chassis, where the components it contains are listed. It is also shown in the photograph in cols. 1 and 2 above, where the two side views are seen with the cover removed. One side shows all the R.F. and oscillator adjustments, while the other shows the inside of the assembly.

At the bottoms of these two views and in the under-chassis illustration the two rows of connecting tags are shown, numbered **1** to **14,** while in the circuit diagram the points at which these connections occur are indicated by arrows and solid circles bearing the same numbers. If it is necessary to remove the assembly for inspection or replacement, reference must be made to these indications when reconnecting it again unless the leads have been coded with labels as they were disconnected.

Scale Lamps.—These are two Osram lamps, with small clear spherical bulbs and M.E.S. bases, rated at 4 V, 0.3 A. They are shunted by a 40 Ω wire-wound resistor **R16.**

Capacitors C25, C26, C27.—These are three electrolytics in a single tubular metal container mounted on the chassis deck. The red tag is the positive of **C25** (8 μF), and the two plain tags are the positives of **C26** and **C27.** The case forms the common negative connection. The unit is rated at 400 V D.C. working.

Line Cord.—This is a multiple cable carrying **R17** as the resistance lead and four flexible conductors. At the receiver end four leads emerge : a maroon braided lead from the near end of **R17,** which goes to **V5** heater; a red rubber lead from the mains end of **R17,** which goes to the 120 V tag on the voltage adjustment panel and to **V5** anode; and two green leads, one from the tapping on **R17,** which goes to the common voltage adjustment bus-bar, and the other from the "negative" side of the mains, which goes to **S12.**

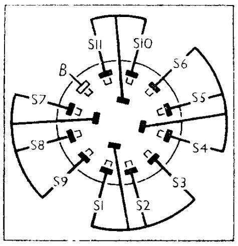
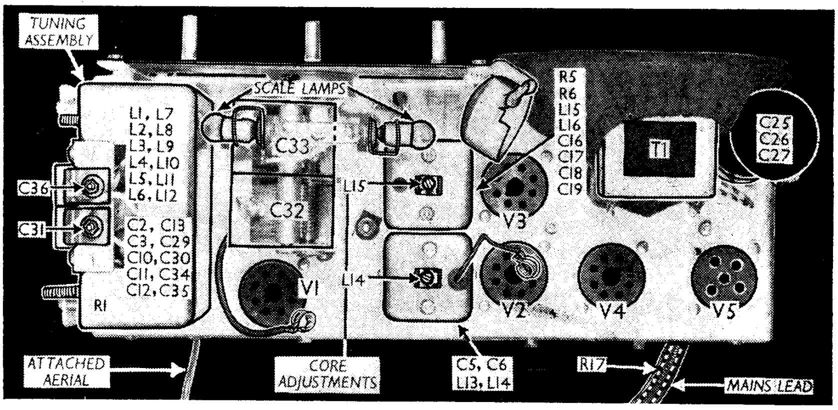


Diagram of the waveband switch unit, drawn as seen when viewed from the rear of an inverted chassis. ***B*** indicates a blank tag.

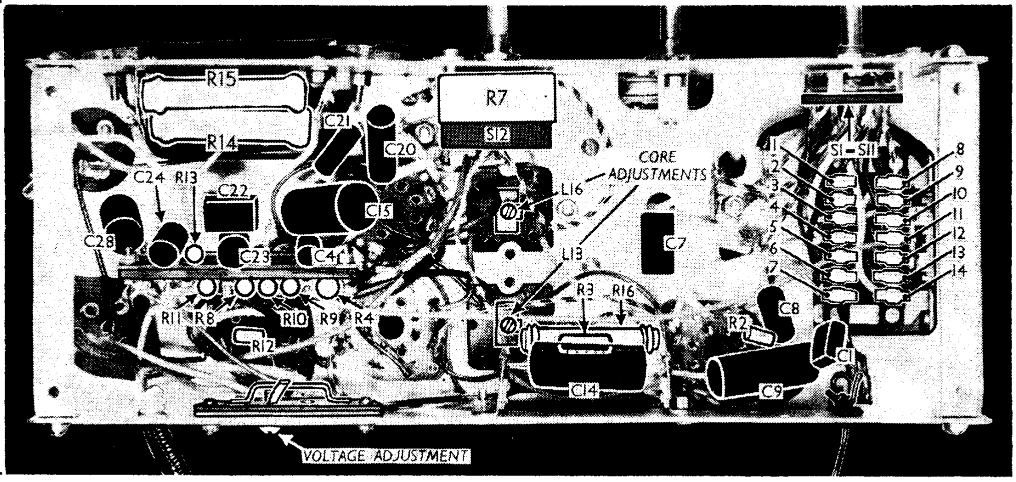
Drive Cord Replacement.—This is very straightforward and requires no description beyond that given in the sketch (col. 4), which shows the position of cord and drum when the gang is at maximum. The sketch is drawn as seen when viewed from the front of the set.

To obtain access to the drum, the scale must be removed (four set-screws) from its supports, after first removing the pointer (pull-off). When replacing the scale, washers go under the heads of the two upper fixing screws, on the face of the scale.



Plan view of the chassis. All the components inside the screened units are indicated here, but those in the tuning assembly are also shown in detail in the illustration above at the head of cols. 1 and 2.

Under-chassis view. The waveband switch unit **S1-S11** is indicated here and shown in detail in the diagram in col. 3. Below the switch are seen the fourteen tags of the tuning assembly, numbered to agree with the circuit diagram overleaf. The numbers are also repeated in the two views of the tuning assembly at the head of cols. 1 and 2 opposite.



CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator leads via a 0.1 μF capacitor to control grid (top cap) of **V1**, leaving original connector in position, and chassis. Tune the receiver to 550 m and turn the volume control to maximum.

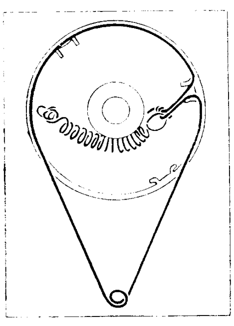
Feed in a 460 kc/s (652.1 m) signal, and adjust the cores of **L16, L15, L14** and **L13**, in that order, for maximum output.

R.F. and Oscillator Stages.—Transfer signal generator leads to one end of attached aerial and chassis, via a suitable dummy aerial. Turn gang to maximum, when the pointer should cover the high wavelength ends of the three scale lines. All the trimmers involved in the following adjustments are grouped together in the tuning assembly. The adjustments are identified on the right in the illustration in cols. 1 and 2, which shows the tuning assembly as it appears when viewed from the end of the chassis after removal from the cabinet.

S.W.—Switch set to S.W., tune to 20 m on scale, feed in a 20 m (15 Mc/s) signal, and adjust **C34**, then **C29**, for maximum output.

M.W.—Switch set to M.W., tune to 550 m on scale, feed in a 550 m (545 kc/s) signal, and adjust the cores of **L8** and **L5** for maximum output. Tune to 250 m on scale, feed in a 250 m (1,200 kc/s) signal and adjust **C35**, then **C30** for maximum output. Repeat the 550 m and 250 m adjustments until no improvement can be obtained.

L.W.—Switch set to L.W., tune to 2,000 m on scale, feed in a 2,000 m (150 kc/s) signal and adjust the cores of **L9** and **L6** for maximum output. Tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C36**, then **C31** for maximum output. Repeat the 2,000 m and 1,000 m adjustments until no improvement can be obtained.



Sketch showing the drive cord system as seen from the front. The cord makes 1½ turns round the control spindle.

CAPACITOR VALUE CONVERSIONS

Microfarads, Micro-microfarads and Picofarads

THE range of values associated with the L. C and R components in modern domestic radio receivers is very wide, so wide indeed that standard units are divided up into sub-units of one-millionth part of a unit, or bunched together in multiples of a million units, like megohms.

In the case of capacitors, this commonly happens twice : the unit of capacitance is the Farad, the practical sub-multiple or "working unit" is the microfarad (one-millionth of a Farad) and the sub-sub-multiple of that, which is now used frequently, is the picofarad or micro-micro-farad. This is one millionth of a microfarad, or one million-millionth of a Farad.

Microfarads to Picofarads

Radio dealers are quite familiar with these terms, but some of them find difficulty in converting them from one degree of magnitude to another when, for instance, a 0.00001 μF capacitor is required and they have 10 pF and 100 pF types in stock. We are frequently asked to publish a conversion table, but there are several reasons why a table is not the best solution of the difficulty. One of them is that it would have to include all possible values from, say, 0.000001 μF (1μμF or 1 pF) to 0.1 μF; another is that it is quite a simple matter and quite as quick to work it out.

The method is to write down the value given, always inserting the decimal point even if the value is a whole number, like 50.0, which might have been given as 50 μμF or 50 pF. Then, if it is desired to convert this to microfarads, divide by one million by shifting the decimal point six places to the left, thus : 0.0000500, or 0.00005 μF. If instead the value given is 0.001 μF, convert it to picofarads by shifting the decimal point six places to the right, giving 0001000.0 or 1,000 pF.

Worked Examples

To make this perfectly clear, three different examples are shown below, where the values in picofarads are written exactly under the same values in microfarads, only the decimal point being altered to make the conversion, thus :

μF :	0.000300	0.000005	0.025000
pF :	000300.0	000005.0	025000.0

Upon removal of the surplus noughts, and in the cases of whole numbers the decimal points, these values read thus :

0.0003 μF	0.000005 μF	0.025 μF
300 pF	5 pF	25,000 pF

If the conversion is practised by this method every time a small capacitor is encountered, the process rapidly becomes automatic and either value can be quoted off-hand. Where the conversion is only needed occasionally, the method described is the quickest way to perform it.

Printed in England by The Cornwall Press Ltd., Paris Garden, London, S.E.1.